

Nationwide use of inhaled corticosteroids by South Korean asthma patients: an examination of the Health Insurance Review and Service database

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Background: Previous studies have found that the prescription rates of inhaled corticosteroid (ICS) were considerably low although it is recommended as the optimal asthma treatment. The aim of this study was to analyze the current status of ICS prescription for asthma patients in the South Korea.

Methods: We evaluated quality assessment data based on nationwide Health Insurance Review and Service (HIRA) database from July 2013 to June 2014. ICS prescription rates in asthma patients were analyzed by types and specialty of medical institutions. Also, we graded medical institutions by their ICS prescription rate. In addition, ICS prescription rates were calculated by patient gender, age, and insurance type.

Results: This study included 831,613 patients and 16,804 institutions in the analysis. The overall mean ICS prescription rate was 22.58%. Tertiary hospitals had the highest mean prescription rate (84.16%) whereas primary healthcare clinics had the lowest (20.71%). By specialty, internal medicine physicians prescribed ICS more frequently compared to other specialists. Of all, 47.17% of medical institutions prescribed ICS to <10% of asthma patients, while less than 6% of institutions prescribed ICS to >80% of asthma patients. Also, we found that female and patients with age >90 or <20 years exhibited lower ICS prescription rate.

Conclusions: The ICS prescription rate was found to be inadequate, given the importance of ICS as an asthma treatment. The prescription rates were especially low in primary healthcare clinics, and by specialists in fields other than internal medicine.

Keywords: Inhaled corticosteroid (ICS); asthma; Health Insurance Review and Service (HIRA); Korea; nationwide-population-based

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Introduction

Asthma is a common chronic disease associated with a substantial social and economic burden. The disease affects 7–10% of all persons worldwide, i.e., more than 300 million people, and its prevalence is increasing (1-3). Asthmatics exhibit low productivity, have a poor quality of life, and must deal with the high financial cost of remedies, especially in sub-optimally controlled patients (4-6). Although high-quality care is helpful, less than half of all asthma is well-controlled (6-9), for various reasons (10,11) including disease-, doctor-, and patient-specific factors. Often, treatment is inappropriate because of physician ignorance and/or patient nonadherence (12). The Global Initiative for Asthma (GINA) 2016 guideline states that inhaled corticosteroid (ICS) should be prescribed to asthma patients at steps 2–5 of disease, and should also be considered for those at step 1 (13). However, previous studies found that ICS use rate was relatively low (14,15). To eliminate such underutilization, it is important to analyze the current status of ICS prescription.

In the South Korea, almost all persons are enrolled in national health insurance (NHI) systems, either the NHI, National Medical Aid (NMA), or the Korea Veterans Health Service (16). All medical institutions claim reimbursements from the Health Insurance Review and Service (HIRA), which monitors and approves such charges. Also, HIRA collects clinical data reported by the claiming doctors. Thus, HIRA has data on almost every asthmatic who has visited a medical institution.

We analyzed the current status of ICS prescriptions in Korea. We studied the ICS prescription rates of various healthcare institutions and medical specialists, and the general characteristics of patients.

Methods

Data source and selection

This was a nationwide population-based study that used the HIRA database on insurance claims made by medical institutions. We extracted patient data from July 2013 to June 2014; these included general demographic data (age, gender, type of insurance); diagnoses based on the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10); and the type of medical institution or medical specialist visited. The inclusion criteria were: (I) age >15 years; (II) primary or first secondary diagnosis of asthma (ICD-10 codes

J45 and J46, respectively); and either (III) prescription of asthma medication more than once in an outpatient clinic or (IV) a history of systemic corticosteroid use plus a visit to an outpatient clinic followed by prescription of asthma medication.

Medical institutions

Medical institutions were categorized as tertiary hospitals, general hospitals, hospitals, convalescent hospitals, primary healthcare clinics, public health centers, branch offices of public health centers, and county hospitals. Definitions of each medical institutions are shown in *Table 1*. Any other medical institution, such as oriental hospitals, dental clinics, and maternity clinics, were excluded, as were medical institutions that did not receive any visits from asthma patients. Doctors were also categorized by medical specialty (internal medicine, general practice, otorhinolaryngology, pediatrics, family medicine, or other). Internal medicine is defined as doctors who graduated medical college, trained in internship and residency and achieved certification of the specialty in internal medicine. General practitioner is defined as doctors who graduated medical college and did not achieved any specialty. Otorhinolaryngology is defined as doctors who graduated medical college, trained in internship and residency and achieved certification of the specialty in otorhinolaryngology. Pediatrics is defined as doctors who graduated medical college, trained in internship and residency and achieved certification of the specialty in pediatrics. Family medicine is defined as doctors who graduated medical college, trained in internship and residency and achieved certification of the specialty in family medicine. Others is defined as doctors who graduated medical college, trained in internship and residency and achieved certification of the specialty other than previous specialties.

ICS prescription rate

The ICS prescription rate was the ratio of the number of patients prescribed ICS to all asthmatics. The rates were calculated for the different medical institutions and specialties. Also, we graded medical institutions by their ICS prescription rate. In addition, we analyzed prescription rates by patient gender, age and 3 different health services (NHI: covers every citizen in the Republic of Korea who are resident in the nation. Exclude people who are covered by NMA or Korea Veterans Health Service. NMA: Covers people who are not capable of make a living by themselves

Table 1 Definitions of each type of medical institutions

Type of medical institutions	Definition
Tertiary hospital	General hospitals which provide specialized medical practice for disease with high severity
General hospital	Hospitals with more than 100 beds and more than 7 or 9 medical specialties
Hospital	Medical center with more than 30 beds
Convalescent hospital	Hospital which mainly provide convalescent services
Primary healthcare clinic	Medical center with less than 30 beds, which mainly provide primary medical service
Public health center	Medical center established by local government
Branches of public health center	Branches of public health center, which covers smaller region in need of medical service
County hospital	Public health center that meet the qualifications as hospital

Table 2 Number of patients by institution type

Type of medical institutions	Subjects for evaluation		Patient number/institution (n)
	Number of institutions (n) (%)	Number of patients (n) (%)	
Overall	16,804 (100.00)	831,613 (100.00)	49.49
Tertiary hospital	43 (0.26)	43,471 (5.23)	1010.95
General hospital	280 (1.67)	83,194 (10.00)	297.12
Hospital	910 (5.42)	44,503 (5.35)	48.90
Convalescent hospital	379 (2.26)	2,933 (0.35)	7.74
Primary healthcare clinic	14,745 (87.75)	686,063 (82.50)	46.53
Public health center	212 (1.26)	2,424 (0.29)	11.43
Branch office of public health center	222 (1.32)	532 (0.06)	2.40
County hospital	13 (0.08)	416 (0.05)	32.00

that government decided to support their maintenance of livelihood, medical wellness, residence and education. Korea Veterans Health Service; Covers patriots and veterans who dedicated to the nation.)

Ethics

Our study was approved by the ethics committee of Seoul St. Mary's Hospital (KIRB-0E482-001).

Statistical analysis

The chi-squared test was used to compare categorical variables. The Mantel-Haenszel chi-squared test was employed to assess correlations between such variables. All statistical analyses were conducted using SAS software (ver.

9.2; SAS Institute, Cary, NC, USA).

Results

Subjects

We included 831,613 patients and 16,804 institutions in the analysis (Table 2). Primary healthcare clinics constituted the largest proportion of institutions (14,745) and treated the most patients (686,063). Number of patients per institution were 46.53. In terms of tertiary hospitals, 43 institutions treated 43,471 patients, and number of patients per institution were 1010.95.

ICS prescription rates

The overall mean ICS prescription rate was 22.58%. The

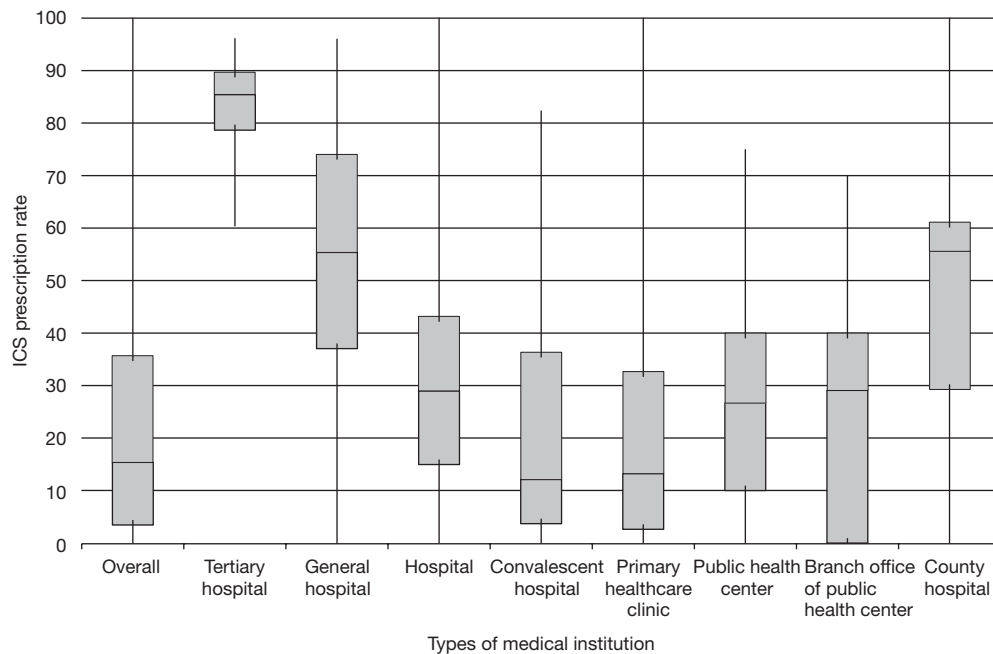


Figure 1 ICS prescription rates of different types of medical institution. Data are expressed as median \pm interquartile range. ICS, inhaled corticosteroid.

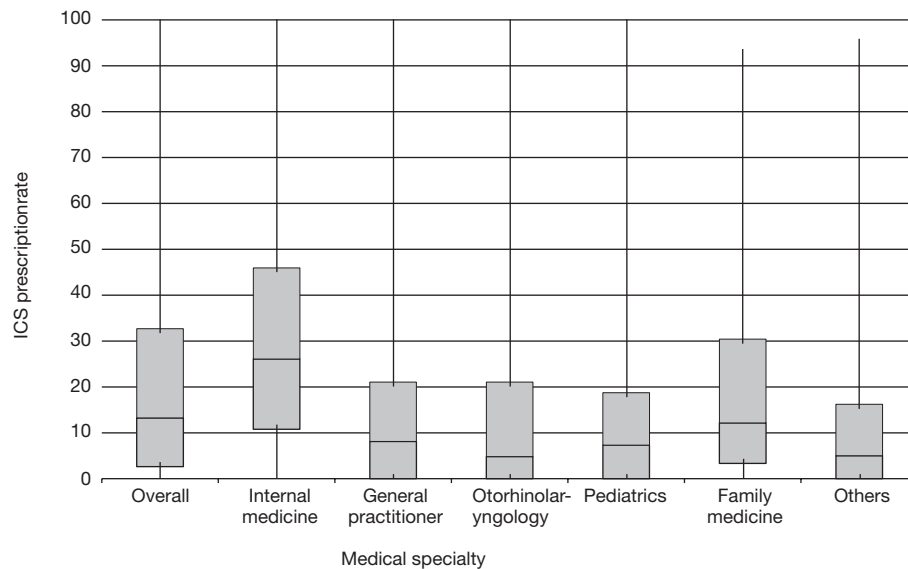


Figure 2 ICS prescription rates by doctors in primary healthcare clinics by medical specialty. Data are expressed as median \pm interquartile range. ICS, inhaled corticosteroid.

prescription rates by medical institution type are shown in *Figure 1*. Tertiary hospitals (84.16%) and general hospitals (54.94%) had the highest mean prescription rates and convalescent hospitals (19.57%), and primary healthcare

clinics (20.71%) had the lowest. ICS prescription rates by doctors in primary healthcare clinics by medical specialty are shown in *Figure 2*. Internal medicine physicians (30.43%) had the highest mean prescription rate and

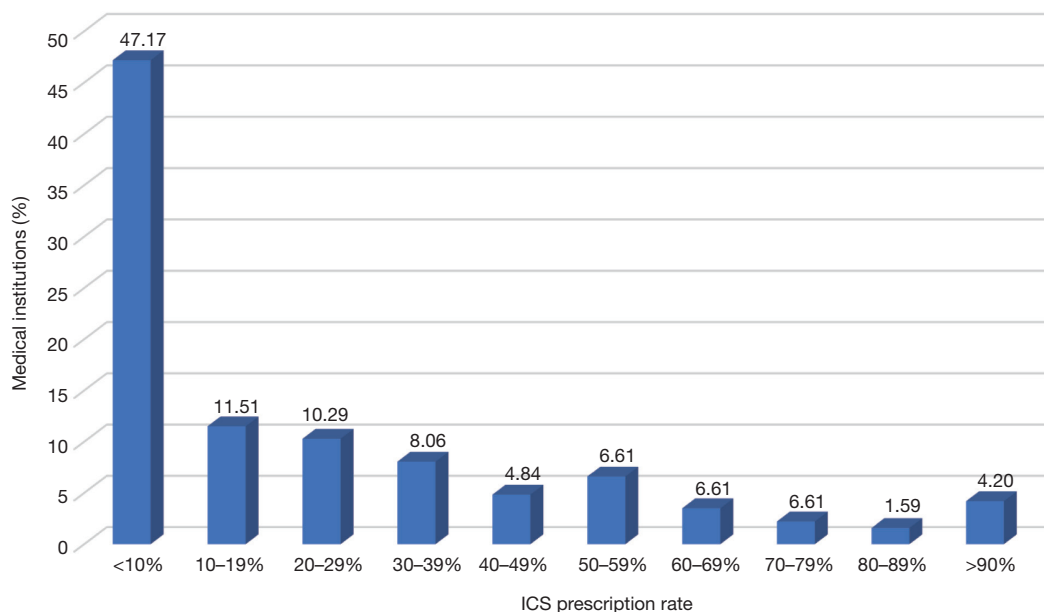


Figure 3 ICS prescription rates of various medical institution (%). X-axis represents range of ICS prescription rate. Y-axis represents percentage of institution according to ICS prescription rate. ICS, inhaled corticosteroid.

all other specialists had mean rates <20%. The ICS prescription rates of the various medical institutions are shown in *Figure 3*. Overall, 47.17% of all institutions prescribed ICS to <10% of asthma patients, and <6% of institutions prescribed ICS to >80% of asthma patients. We also studied ICS prescription rate by general patient characteristics (*Figure 4*). Male patients received more ICS prescriptions than females (28.87% vs. 23.06%, $P<0.001$ by the chi-squared test). Although patients aged 20–90 years exhibited similar prescription rates, the rates for those aged >90 or <20 years were lower ($P<0.001$ by the chi-squared test). Patients covered by the Korean Veterans Health Service had a higher ICS prescription rate than those covered by the NHI or NMA (44.56% vs. 25.06% vs. 29.69%, $P<0.001$ by the chi-squared test, $P<0.001$ by the Mantel-Haenszel chi-squared test).

Discussion

Asthma treatment focuses on alleviation of impairment and reduction of risks (17). ICS is very useful in these contexts (18,19). Most treatment guidelines suggest that ICS should be used by asthma patients with persistent symptoms (17,20). Furthermore, increasing evidence suggests that ICS should be considered for those with mild asthma (intermittent symptoms) (step 1 disease of the GINA

guideline); this was not recommended previously (21,22).

HIRA performed a qualitative assessment of asthma care after reviewing all medical institutions of Korea, and their prescriptions (23), seeking to improve the quality of asthma care by assessing diagnoses and treatments. We used this database to explore the current status of ICS prescriptions in Korea; we evaluated 831,613 patients and 16,804 institutions. The overall ICS prescription rate was 22.58% and almost half of all institutions prescribed ICS to <10% of asthma patients. Only 6% of institutions prescribed ICS to >80% of patients, which may be appropriate. This is disappointing because ICS is the optimal asthma treatment (13).

ICS is under prescribed by primary healthcare clinics: the prescription rate was 84.16% in tertiary hospitals but only 20.71% in primary healthcare clinics. Promotion of guideline-based therapy in such clinics is key to improve asthma care nationwide. This discrepancy may be a result of different patient number per institution between each type of medical institutions. In tertiary hospital, annual patient number per institution count up to 1,010.95 which may help to maintain specialty for asthma treatment. However, in primary healthcare clinic, the number is much lower as 46.53 that specialized asthma treatment may be compromised. Also, there are some possibility that different disease severities have affected this result. Severe asthma patients may have visited higher grade medical

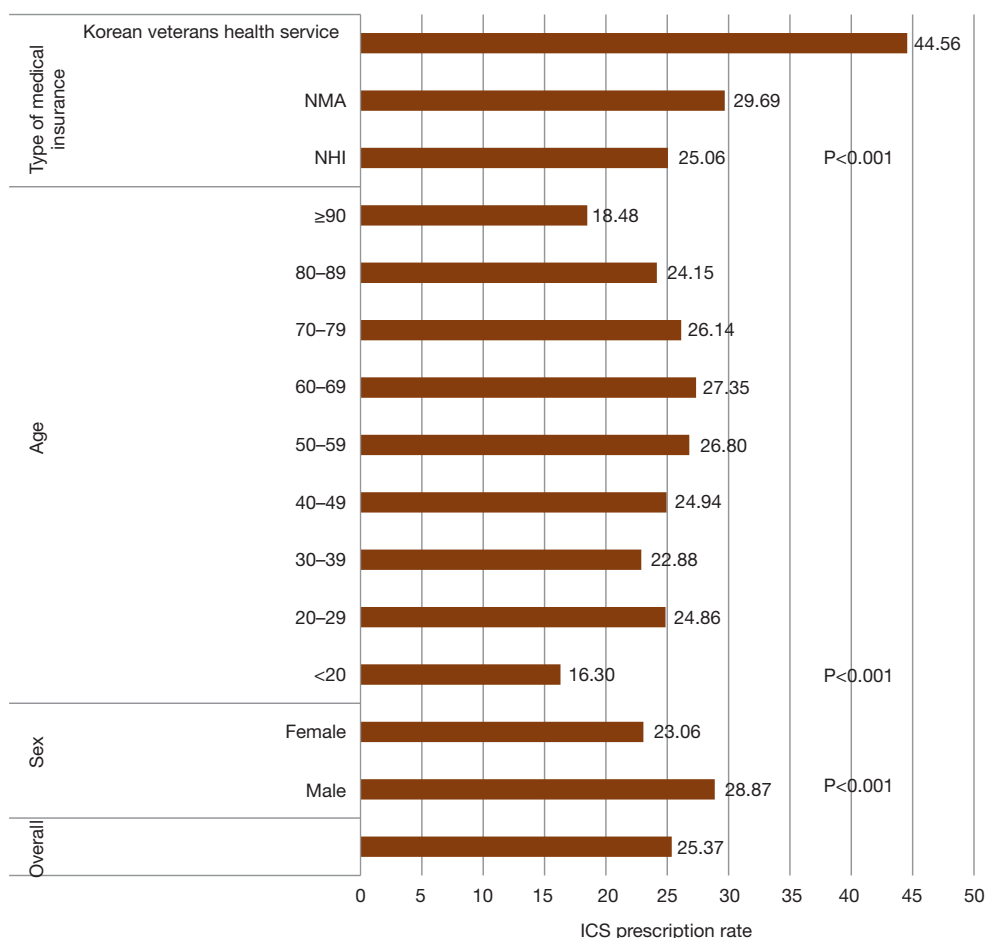


Figure 4 ICS prescription rates according to general patient characteristics. ICS, inhaled corticosteroid; NMA, National Medical Aid; NHI, national health insurance.

institutions and the prescription rate of ICS would be expected to be higher for those patients. Also, specialists other than internal medicine physicians prescribed ICS very infrequently. Although this result also may have been affected by different disease severity between various medical specialty, undereducation and neglect of ICS in asthma treatment may have been most important factor. Therefore, more improvement should be made especially for primary healthcare clinics or general practitioners. Education and monitoring system should be established for doctors in primary healthcare clinics and general practitioners. Also, system should be made which connects primary healthcare clinics or medical institutions in absence of internal medicine specialists to higher grade hospital for treatment of severe, uncontrolled asthma patients.

There are also some specific problems in Korea regarding low rate of ICS use. First, there is cultural preference

for oral medication. Many Korean patients are not still familiar with inhaler. Some patients even refuse to use inhaler. Second, the number of doctors is relatively limited and Korean doctors should take care of many patients in limited time. Thus, time for education for inhaler technique is insufficient. Due to this reason, especially in primary care clinic, doctors give up prescribing inhalers. Third, reimbursement of inhaler also can be a reason. For example, reimbursement criteria for combination therapy of ICS and long acting β_2 -agonist (ICS/LABA) is asthma patients with partly or uncontrolled. However, some doctors, especially general practitioners, are not exactly aware of these criteria and having hard time to prescribe inhaler.

Previous studies reported that ICS prescription rates ranged from 13% to 77% of the asthmatic population (14,24-28). Several studies showed that ICS prescription rate was disappointing as our study. The Asthma Insights and

Reality in Asia-Pacific Study (AIRIAP), which enrolled eight centers in the Asia-Pacific region, reported a lowest ICS prescription rate of 13% (14). A study which enrolled 2,509 asthma patients in United States by telephone survey reported ICS prescription rate as 15% (27). European Community Respiratory Health Survey (ECRHS) II, which is a multicenter study participated by 48 centers in Europe, reported better result of 43%, however the number is still low regarding to the guideline (26). As adherence to long-term ICS therapy was known to be poor in >75% of patients, many asthma patients may not have been receiving appropriate treatment (29).

In contrast, studies from several countries have reported relatively higher ICS prescription rate. A cross-sectional survey proceeded in New Zealand and Australia reported ICS prescription rate of 68.8% and 60.9% (28). This result may have been obtained by universal public health system, directed by well-educated general practitioner and specialists. In Canada, primary care models were improved to provide more comprehensive care (25). The ICS prescription rate rose by 5.1% over 4 years (from 72.9% to 76.6%, $P < 0.001$). As the baseline rate was already relatively high, the improvement would be greater in other countries with low pre-improvement baselines.

We found that male and elderly patients (aged 50 to 80) received ICS more often than female and younger patients. Possible reason for the age difference is that elderly patients tend to have more severe disease and require higher ICS dose compared to younger patients (30). Doctors may have been more cautious when treating asthma patients with severe disease status. However, as previous studies showed that disease severity is higher in female patients, other factors may have influenced the gender difference (31,32). Further studies are needed, especially for the gender difference of disease severity in the South Korea.

Previous studies reported conflicting results for age and gender difference of ICS prescription rate. Steppuhn *et al.* found that the ICS prescription rate was higher in males (39.9% *vs.* 37.5%) and the elderly (84% *vs.* 67%) than in female and younger patients, in agreement with our findings (24). However, Schatz *et al.* reported that females received ICS more often than males (33), perhaps because disease severity was greater in females, as reflected in a higher hospitalization rate (OR: 1.70).

Difference of ICS prescription rate between different health service may be explained by different medical cost burdened to patients. Korean Veterans Health Service and NHA covers profound amount of medical costs compared to

NHI, which may improve accessibility to better medical care.

A strength of our study was that we used a very large nationwide database (with information on >50,000,000 persons) and evaluated a large number of institutions. As HIRA covers almost all medical expenses incurred in Korea, the database reliably reflects real-world asthma care (15). Also, to the best of our knowledge, this is the first study to show that ICS prescription rate differs by physician specialty. This study provides valuable reference data on asthma care, which will guide healthcare policy seeking to improve the quality of asthma management.

However, our work had certain limitations. First, the study was observational and retrospective in nature; several forms of bias, such as selection bias or observer bias, may have been present. However, the HIRA database has minimal missing data, such that bias may be well controlled. Second, we evaluated only 1-year data; longer follow-up is needed. Also, we included only asthma patients who visited healthcare centers at least twice. Some patients may visit less than once a year, so we may have underestimated the asthma population on that basis (34,35). Since we collected nationwide claim data during one-year period from not only referral hospital but also primary care clinics, we believe the number of asthma patients who did not use any asthma medication for a year were very small. Third, we defined asthma patients only by ICD-10 code and prescription of asthma medication. However, our working definition of asthma has been used consistently in our previous studies (15,36,37).

Conclusions

We analyzed the nationwide 2013 HIRA database to assess national ICS prescription rates in asthmatics; the rate was found to be inadequate, given the importance of ICS as an asthma treatment. The prescription rates were especially low in primary healthcare clinics, and by specialists in fields other than internal medicine.

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Footnote

Conflicts of Interest: CK Rhee received consulting/lecture fees from MSD, AstraZeneca, Novartis, GSK, Takeda,

Mundipharma, Sandoz, Boehringer-Ingelheim, and Teva-Handok. The other authors have no conflicts of interest to declare.

Ethical Statement: Our study was approved by the ethics committee of Seoul St. Mary's Hospital (KIRB-0E482-001).

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